BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-271909
(43)Date of publication of application : 21.10.1997

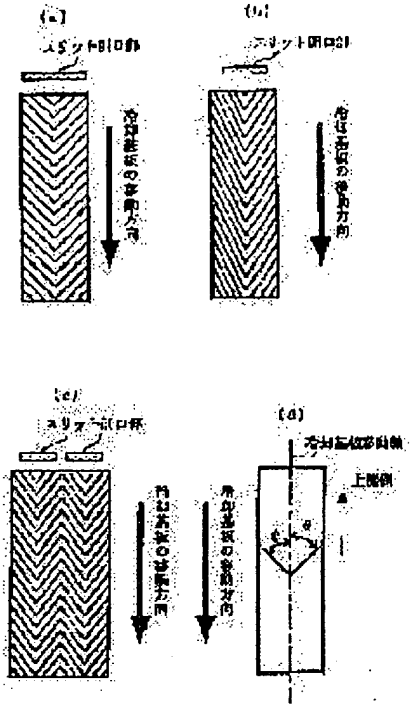
(51)Int.Cl. B22D 11/06
B22D 11/06

(21)Application number : 08-083826
(22)Date of filing : 05.04.1996

(71)Applicant : NIPPON STEEL CORP
(72)Inventor : YAMADA TOSHIO
SAKAMOTO HIROAKI

(54) COOLING BASE BOARD FOR PRODUCING QUENCHED METAL THIN STRIP

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent generation of air pocket and to uniformize and improve magnetic characteristic and mechanical characteristic of a metal thin strip by forming V-shaped grooves on the surface of a cooling base board (roll) used for producing the metal thin strip.
SOLUTION: V-shaped grooves are formed on the surface of the moving cooling base board and constituted so as to direct the closed direction of these grooves to the moving direction (the arrow mark) of the cooling base board. By this constitution, atmospheric gas entrapped between molten metal and the cooling base board is efficiently ejected to the side direction of a paddle and the generation of the air pocket is prevented and cooling speed of the thin strip can be quickened. In this case, the angle θ of the V-shaped grooves is $>0°$ to $<90°$ angle to the upstream direction, desirably 20-70°, by using the moving axis of the cooling base board as a reference. further, the V grooves can be arranged at the different angle in the right and left sides, such as the figure (b), to the shifting axis of the cooling base board passing the closed part, but in this case, the difference of the θ s at the right and the left sides is within $\pm 10°$ to stabilize the paddle.



LEGAL STATUS

[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]

board = roll

CLAIMS

[Claim(s)]
[Claim 1] The cooling substrate for quenching metal thin band manufacture characterized by the direction which has a V character-like slot on the front face of a cooling substrate, and the slot of the shape of this V character closed being suitable in the move direction of a cooling substrate in the equipment which molten metal is made to blow off through the teeming nozzle which has slit-like opening, is made to carry out rapid solidification, and manufactures a quenching metal thin band on the cooling substrate which moves.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the member for equipments for manufacturing the quenching metal thin band used for iron core material, such as a transformer for power, and a high frequency transformer.
[0002]
[Description of the Prior Art] As a method of manufacturing a thin band continuously, the centrifugal quenching method, the single rolling method, the congruence rolling method, etc. are learned by quenching an alloy from a melting state. By making molten metal blow off from an orifice etc. to the inner skin or the periphery side of a metal drum which carries out high-speed rotation, these methods make molten metal solidify quickly, and manufacture a thin band and a wire rod. Furthermore, by choosing alloy composition proper, an amorphous alloy similar to a liquid metal can be obtained, and a material excellent in the magnetic property or the mechanical property can be manufactured.
[0003] These quenching metal thin bands contact a molten metal to a cooling substrate, as mentioned above, and they are manufactured by carrying out rapid **** of the molten metal, and making it solidify. Therefore, in order to quench efficiently, it is important to raise the adhesion of a molten metal and a cooling substrate. However, a controlled atmosphere will be actually involved in between a molten metal and a cooling substrate, and the hollow called air pocket will be generated in thin **** in contact with a cooling substrate. Since the portion of this air pocket is a portion to which the thin band does not touch a cooling substrate, a cooling rate becomes slow from the portion to which the thin band touches the cooling substrate. Consequently, crystallization will take place in the portion of an air pocket, and magnetic properties or a mechanical characteristic will deteriorate.
[0004] In order to decrease an air pocket, a carbon monoxide and oxygen are burned near the paddle on [movable] a cooling object (hearth) at a predetermined rate, and the method of controlling casting atmosphere by making it into low density reducing-flame nature atmosphere near the paddle is indicated (****** No. 501924 [one to] official report). However, a facility not only becomes complicated, but as for this method, a manufacturing cost will become high. Moreover, in order to use a carbon monoxide, a problem comes out also at the safety on operation.
[0005] Moreover, in order to reduce the granularity of the cooling object (JP,62-166059,A) whose front face is the irregularity below micron order by buffing in order to decrease the blemish and crack of a thin band front face. and a thin band free surface How to make a cooling roller front face the granularity ground and obtained with the abrasive paper of the abrasive grain No of No. 600-1000 (JP,4-288952,A), There is a thin band (JP,60-72648,A) manufactured by the cooling object and it which have a scratch in a cooling roller front face aslant to a hand of cut with an eye on magnetic-domain fragmentation of a thin band. However, the publication about an air pocket does not have each in these well-known examples.
[0006]
[Problem(s) to be Solved by the Invention] It can make it have come as a method of reducing an air pocket, conventionally to decrease an air pocket also by the cooling substrate by which there is nothing that has a simple facility and the shape of surface type with a simple facility was controlled. Even if air is involved in between a paddle and a molten metal, the eccrisis is performed efficiently, and this invention decreases the air pocket of a thin band easily, maintains contact to a cooling substrate and a molten metal efficiently, and aims to let a property offer the cooling substrate for quenching metal thin band manufacture from which a good thin band is obtained.
[0007]
[Means for Solving the Problem] this invention is a thing as given in the following. The cooling substrate characterized by for the direction whieh has a V character-like slot on the front face of a cooling substrate, and the slot of the shape of this V character closed in the equipment which is made to blow off and carry out the

involved in the paddle 2 from the upstream expands with the heat of a molten metal, and an air pocket is formed when it solidifies as it is. The conventional cooling substrate has a concave slot to the hand of cut and in parallel of a cooling substrate it was formed of polish, and the air involved in in the paddle moves so that the upstream of a paddle may extrude. However, in order that new air may enter continuously from an upstream, it becomes difficult for air to fall out to an upstream through this concave slot.

[0009] Unlike such a conventional slot, this invention discharges air efficiently not on a paddle upstream but on the side by forming a V character-like slot on a cooling substrate, as shown in drawing 1 , it aims at decreasing an air pocket, repeats various experiments, and results in completion. The point of this invention is making the once involved-in air discharge from the paddle side without the contamination of air. It became possible to extract air easily by this. In the cooling object which has a scratch aslant to the hand of cut of the conventional cooling roller, although the same effect was expected, when actually tried, an air pocket was not able to be reduced. This is because the paddle became unstable on the contrary, as a result of the involved-in air being discharged by only the side of one side of a paddle.

[0010] In this invention, as shown in drawing 1 (a), (b), and (c), the V character-like slot is arranged so that it may close to the move direction of a cooling substrate. Air is efficiently discharged in the direction of the paddle side by this arrangement. When it has been arranged so that arrangement of a V character-like slot may open to the move direction of a cooling substrate, in order that the extruded air may gather in the center section of the direction of a thin bandwidth, eccrisis of air is not performed and an air pocket does not decrease as usual. What is necessary is just to use the cooling substrate of the gestalt shown in drawing 1 (c), in raising productivity.

[0011]

[Embodiments of the Invention] The cooling substrate for quenching metal thin band manufacture of this invention is explained. As for the quality of the material of a cooling substrate, what has large thermal conductivity is good. For example, Cu, Cu alloy, Fe alloy, or the thing that gave them Cr plating is suitable. Although it is suitable since roll methods, such as the single rolling method and the congruence rolling method, are stabilized and a thin band can be manufactured as a cooling substrate, it is a book also with the belt method

[0012] The slot of the shape of V character on a cooling substrate is arranged so that it may close to the move direction of a cooling substrate, as shown in drawing 1 (a), (b), and (c). The angle with the direction of the upstream to make exceeds 0 degree on the basis of the move shaft of a cooling substrate, and the angle theta of a slot is less than 90 degrees, as shown in drawing 1 (d). In order to discharge air efficiently and to acquire a bigger effect, the angle of 20 degrees - 70 degrees is desirable. Moreover, a slot may be arranged at a right-and-left ******** angle like drawing 1 (b) to the move shaft of the cooling substrate which passes along the portion which the shape of V character closed. In this case, in order to stabilize a paddle, as for the difference of theta on either side, it is desirable to make it less than **10 degrees. It is more more desirable to be near the center of the direction of a thin bandwidth, although the peak portion which the V character-like slot closed should just be within the limits of a thin bandwidth.

[0013] The opening width of face of a slot has desirable about 0.1-50 micrometers. It is because air will not move efficiently in the inside of a slot if it becomes smaller than about 0.1 micrometers, the probability that a molten metal will also enter into a slot will become high if it becomes larger than about 50 micrometers, and movement of air is barred. As for a slot, continuing is desirable. When the slot is continuing, it is because air is discharged efficiently. There should just be about 10 micrometers or more of the depth of flute. It is because air will not move efficiently in the inside of a slot if it becomes smaller than about 10 micrometers.

[0014] The peak portion which the V character-like slot closed may have an intersection about 1mm or less. Although the air which moves from a downstream gathers for an intersection, since it is connected with the V character-like slot, air does not pile up. In order to acquire a bigger effect, it is desirable that the intersection has closed completely. The interval (pitch) of a slot and a slot should just be about 200 micrometers or less. When a pitch becomes larger than about 200 micrometers, the involved-in air is not discharged efficiently and is a shell. The slot of a cooling substrate can be formed with machine grinding, a rotation brush, a stamp, etc. Moreover, also on-line, these methods can be held.

[0015]

[Example] Hereafter, this invention is further explained based on an example and the example of comparison. The thin band was manufactured by the single rolling method for having used the cooling roller (cooling roller made from Cu whose outer diameter is 580mm) with the slot of the shape of V character which is example 1 this invention. Once a cooling roller ground a roll front face in the shape of a mirror plane, it made the V character-like slot form by machine grinding. The angle with the direction of the upstream to make had the angle whose right and left are 45 degrees on the basis of the move shaft of the cooling roller which passes along the portion into which the shape of V character closed this slot, and the opening width of face of a slot was [the pitch of 16 micrometers and a slot of 30 micrometers and the depth of flute] 130 micrometers.

[0016] The thin band was manufactured by the single rolling method for having used the cooling roller (cooling

roller made from Cu whose outer diameter is 580mm) which has arranged the slot of the shape of V character opened as an example 2 of example of comparison 2 comparison in the move direction of a cooling substrate contrary to the direction of the slot of the shape of V character of this invention. Once this cooling roller ground a roll front face in the shape of a mirror plane, it made the V character-like slot form by machine grinding like the cooling roller of the example 1 of this invention. The angle with the direction of the upstream to make had the angle whose right and left are 120 degrees on the basis of the move shaft of the cooling roller which passes along the portion into which the shape of V character closed this slot, and the opening width of face of a slot was [the pitch of 16 micrometers and a slot of 30 micrometers and the depth of flute] 130 micrometers.

[0018] Composition of each alloy of the thin film of this invention material and the comparison material 1 and 2 is Fe80.5Si6.5B12Cl (atomic %). The quartz crucible was loaded with 750g of this hardener, after carrying out the RF dissolution, the molten metal was made to blow off from a nozzle with slit-like opening on the above-mentioned cooling roller which carries out high-speed rotation with the peripheral speed of 24m/second, and the thin band was obtained. The used nozzle is a single slit nozzle (width of face of 0.4mm, a length of 25mm). As for 27 micrometers of each obtained thin band, 25mm and board thickness have width of face.

[0019] The cooling roller contact surface (roll side) of a thin band was photographed in the **** photograph, and the rate of area of an air pocket was investigated using the image processing system. Moreover, magnetic annealing of this thin band was carried out in nitrogen atmosphere at 360 degrees C for 1 hour, and magnetic properties were measured by SST. The result is shown in Table 1.

[0020]

[Table 1]

表 1

例	エアポケットの面積率 %	鉄損値 W13/50 W/kg
本発明材	10	0.10
比較材1	21	0.14
比較材2	25	0.16

[0021] The thin band which produced the rate of area of an air pocket by the cooling roller of this invention to the thin band of the comparison material 1 being [the thin band of 21% and the comparison material 2] 25% was 10%. In optical microscope observation of the comparison material 2, the big air pocket in the place equivalent to the portion which the V character-like slot closed was observed. Moreover, this invention material was 0.10W/kg to the comparison material 1 being [0.14W / kg / /and the comparison material 2 of the iron loss value of each thin band] 0.16W/kg in W13 / 50 (flux density 1.3T, iron loss value in 50Hz). As these results show the cooling substrate of this invention decreases the air pocket of a thin band, and the magnetic properties of a thin band are improved by it.

[0022]

[Effect of the Invention] According to this invention, since the facility of complicated controlled-atmosphere equipment, an auxiliary cooling roller, etc. is unnecessary while the cooling rate of a thin band can be enlarged easily and the property of a thin band can be raised, without using complicated controlled-atmosphere equipment, an auxiliary cooling roller, etc., a manufacturing cost can be made cheap. Moreover, since it is based neither on a component system nor the board thickness of a thin band but the big cooling effect is acquired, scopes are latus. furthermore, the thing which an air pocket decreases -- the front face where irregularity is small -- the good thin band of a character is obtained This leads also to improvement in a volume iron core and the space factor at the time of stacking and making it an iron core.

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the member for equipments for manufacturing the quenching metal thin band used for iron core material, such as a transformer for power, and a high frequency transformer.

alloy from a melting state. By making molten metal blow off from an orifice etc. to the inner skin or the periphery side of a metal drum which carries out high-speed rotation, these methods make molten metal solidify quickly, and manufacture a thin band and a wire rod. Furthermore, by choosing alloy composition proper, an amorphous alloy similar to a liquid metal can be obtained, and a material excellent in the magnetic property or the mechanical property can be manufactured.

[0003] These quenching metal thin bands contact a molten metal to a cooling substrate, as mentioned above, and they are manufactured by carrying out rapid **** of the molten metal, and making it solidify. Therefore, in order to quench efficiently, it is important to raise the adhesion of a molten metal and a cooling substrate. However, a controlled atmosphere will be actually involved in between a molten metal and a cooling substrate, and the hollow called air pocket will be generated in thin **** in contact with a cooling substrate. Since the portion of this air pocket is a portion to which the thin band does not touch a cooling substrate, a cooling rate becomes slow from the portion to which the thin band touches the cooling substrate. Consequently, crystallization will take place in the portion of an air pocket, and magnetic properties or a mechanical characteristic will deteriorate.

[0004] In order to decrease an air pocket, a carbon monoxide and oxygen are burned near the paddle on [movable] a cooling object (hearth) at a predetermined rate, and the method of controlling casting atmosphere by making it into low density reducing-flame nature atmosphere near the paddle is indicated (****** No. 501924 [one to] official report). However, a facility not only becomes complicated, but as for this method, a manufacturing cost will become high. Moreover, in order to use a carbon monoxide, a problem comes out also at the safety on operation.

[0005] Moreover, in order to reduce the granularity of the cooling object (JP,62-166059.A) whose front face is the irregularity below micron order by buffing in order to decrease the blemish and crack of a thin band front face, and a thin band free surface, There is a thin band (JP,60-72648,A) manufactured by the cooling object and it which have a scratch in a cooling roller front face aslant to a hand of cut with an eye on magnetic-domain fragmentation of the method (JP,4-288952,A) of making a cooling roller front face the granularity ground and obtained with the abrasive paper of the abrasive grain No of No. 600-1000 and a thin band. However, the publication about an air pocket does not have each in these well-known examples.

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, since the facility of complicated controlled-atmosphere equipment, an auxiliary cooling roller, etc. is unnecessary while the cooling rate of a thin band can be enlarged easily and the property of a thin band can be raised, without using complicated controlled-atmosphere equipment, an auxiliary cooling roller, etc., a manufacturing cost can be made cheap. Moreover, since it is based neither on a component system nor the board thickness of a thin band but the big cooling effect is acquired, a scope is wide. furthermore, the thing which an air pocket decreases -- the front face where irregularity is small -- the good thin band of a character is obtained This leads also to improvement in a volume iron core and the space factor at the time of stacking and making it an iron core.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] It can make it have come as a method of reducing an air pocket, conventionally to decrease an air pocket also by the cooling substrate by which there is nothing that has a simple facility and the shape of surface type with a simple facility was controlled. Even if air is involved in between a paddle and a molten metal, the discharge is performed efficiently, and this invention decreases the air pocket of a thin band easily, maintains contact to a cooling substrate and a molten metal efficiently, and aims to let a property offer the cooling substrate for quenching metal thin band manufacture from which a good thin band is obtained.

MEANS

[Means for Solving the Problem] this invention is a thing as given in the following. The cooling substrate characterized by for the direction which has a V character-like slot on the front face of a cooling substrate, and the slot of the shape of this V character closed in the equipment which is made to blow off and carry out the rapid solidification of the molten metal through the teeming nozzle which has slit-like opening on the cooling substrate which moves, and manufactures a quenching metal thin band to be suitable in the move direction of a cooling substrate.

[0008] Below, this invention is explained in detail. As shown in drawing 2 , the controlled atmosphere (air)

becomes difficult for air to fall out to an upstream through this concave slot.
[0009] Unlike such a conventional slot, this invention discharges air efficiently not on a paddle upstream but on the side by forming a V character-like slot on a cooling substrate, as shown in drawing 1 , it aims at decreasing an air pocket, repeats various experiments, and results in completion. The point of this invention is making the once involved-in air discharge from the paddle side without the contamination of air. It became possible to extract air easily by this. In the cooling object which has a scratch aslant to the hand of cut of the conventional cooling roller, although the same effect was expected, when actually tried, an air pocket was not able to be reduced. This is because the paddle became unstable on the contrary, as a result of the involved-in air being discharged by only the side of one side of a paddle.
[0010] In this invention, as shown in drawing 1 (a), (b), and (c), the V character-like slot is arranged so that it may close to the move direction of a cooling substrate. Air is efficiently discharged in the direction of the paddle side by this arrangement. When it has been arranged so that arrangement of a V character-like slot may open to the move direction of a cooling substrate, in order that the extruded air may gather in the center section of the direction of a thin bandwidth, discharge of air is not performed and an air pocket does not decrease as usual What is necessary is just to use the cooling substrate of the form shown in drawing 1 (c), in raising productivity.
[0011]
[Embodiments of the Invention] The cooling substrate for quenching metal thin band manufacture of this invention is explained. As for the quality of the material of a cooling substrate, what has large thermal conductivity is good. For example, Cu, Cu alloy, Fe alloy, or the thing that gave them Cr plating is suitable. Although it is suitable since roll methods, such as the single rolling method and the congruence rolling method, are stabilized and a thin band can be manufactured as a cooling substrate, it is a book also with the belt method
[0012] The slot of the shape of V character on a cooling substrate is arranged so that it may close to the move direction of a cooling substrate, as shown in drawing 1 (a), (b), and (c). The angle with the direction of the upstream to make exceeds 0 degree on the basis of the move shaft of a cooling substrate, and the angle theta of a slot is less than 90 degrees, as shown in drawing 1 (d). In order to discharge air efficiently and to acquire a bigger effect, the angle of 20 degrees - 70 degrees is desirable. Moreover, a slot may be arranged at a right-and-left ******** angle like drawing 1 (b) to the move shaft of the cooling substrate which passes along the portion which the shape of V character closed. In this case, in order to stabilize a paddle, as for the difference of theta on either side, it is desirable to make it less than **10 degrees. It is more more desirable to be near the center of the direction of a thin bandwidth, although the peak portion which the V character-like slot closed should just be within the limits of a thin bandwidth.
[0013] The opening width of face of a slot has desirable about 0.1-50 micrometers. It is because air will not move efficiently in the inside of a slot if it becomes smaller than about 0.1 micrometers, the probability that a molten metal will also enter into a slot will become high if it becomes larger than about 50 micrometers, and movement of air is barred. As for a slot, continuing is desirable. When the slot is continuing, it is because air is discharged efficiently. There should just be about 10 micrometers or more of the depth of flute. It is because air will not move efficiently in the inside of a slot if it becomes smaller than about 10 micrometers.
[0014] The peak portion which the V character-like slot closed may have an intersection about 1mm or less. Although the air which moves from a downstream gathers for an intersection, since it is connected with the V character-like slot, air does not pile up. In order to acquire a bigger effect, it is desirable that the intersection has closed completely. The interval (pitch) of a slot and a slot should just be about 200 micrometers or less. When a pitch becomes larger than about 200 micrometers, the involved-in air is not discharged efficiently and is a shell. The slot of a cooling substrate can be formed with machine grinding, a rotation brush, a stamp, etc. Moreover, also on-line, these methods can be held.

EXAMPLE

[Example] Hereafter, this invention is further explained based on an example and the example of comparison. The thin band was manufactured by the single rolling method for having used the cooling roller (cooling roller made from Cu whose outer diameter is 580mm) with the slot of the shape of V character which is example 1 this invention. Once a cooling roller ground a roll front face in the shape of a mirror plane, it made the V character-like slot form by machine grinding. The angle with the direction of the upstream to make had the angle whose right and left are 45 degrees on the basis of the move shaft of the cooling roller which passes along the portion into which the shape of V character closed this slot, and the opening width of face of a slot was [the pitch of 16 micrometers and a slot of 30 micrometers and the depth of flute] 130 micrometers.
[0016] The thin band was manufactured by the single rolling method for having used the cooling roller (cooling roller made from Cu whose outer diameter is 580mm) which gave polish by the usual emery paper as an

opened as an example 2 of example of comparison 2 comparison in the move direction of a cooling substrate contrary to the direction of the slot of the shape of V character of this invention. Once this cooling roller ground a roll front face in the shape of a mirror plane, it made the V character-like slot form by machine grinding like the cooling roller of the example 1 of this invention. The angle with the direction of the upstream to make had the angle whose right and left are 120 degrees on the basis of the move shaft of the cooling roller which passes along the portion into which the shape of V character closed this slot, and the opening width of face of a slot was [the pitch of 16 micrometers and a slot of 30 micrometers and the depth of flute] 130 micrometers.

[0018] Composition of each alloy of the thin film of this invention material and the comparison material 1 and 2 is Fe80.5Si6.5B12Cl (atomic %). The quartz crucible was loaded with 750g of this hardener, after carrying out the RF dissolution, the molten metal was made to blow off from a nozzle with slit-like opening on the above-mentioned cooling roller which carries out high-speed rotation with the peripheral speed of 24m/second. and the thin band was obtained. The used nozzle is a single slit nozzle (width of face of 0.4mm, a length of 25mm). As for 27 micrometers of each obtained thin band, 25mm and board thickness have width of face.

[0019] The cooling roller contact surface (roll side) of a thin band was photographed in the **** photograph, and the rate of area of an air pocket was investigated using the image processing system. Moreover, magnetic annealing of this thin band was carried out in nitrogen atmosphere at 360 degrees C for 1 hour, and magnetic properties were measured by SST. The result is shown in Table 1.

[0020]

[Table 1]

表 1

例	エアポケットの面積率 %	鉄損値 W13/50 W/kg
本発明材	10	0.10
比較材1	21	0.14
比較材2	25	0.16

[0021] The thin band which produced the rate of area of an air pocket by the cooling roller of this invention to the thin band of the comparison material 1 being [the thin band of 21% and the comparison material 2] 25% was 10%. In optical microscope observation of the comparison material 2, the big air pocket in the place equivalent to the portion which the V character-like slot closed was observed. Moreover, this invention material was 0.10W/kg to the comparison material 1 being [0.14W / kg / /and the comparison material 2 of the iron loss value of each thin band] 0.16W/kg in W13 / 50 (flux density 1.3T, iron loss value in 50Hz). As these results show the cooling substrate of this invention decreases the air pocket of a thin band, and the magnetic properties of a thin band are improved by it.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the ** type view showing the pattern of the cooling substrate of this invention, and a V character-like slot. (a) A V character-like slot the example which is a bilateral symmetry, and (b) to the move shaft of a cooling substrate A V character-like slot shows an example in case the example from which the angle on either side differs to the move shaft of a cooling substrate, and (c) manufacture two kinds of thin bands simultaneously, and (d) shows the definition of the angle theta of a slot.

[Drawing 2] It is explanatory drawing in thin band manufacture showing the principle which can do an air pocket, and the ** type view which looked at (a) from the upper part of a cooling substrate, and (b) are the ** type views seen from the side of a cooling substrate.

[Description of Notations]

1 Cooling Substrate
2 Paddle
3 Molten Metal
4 Nozzle
5 Thin Band

---

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平9－271909

(43)公開日　平成９年(1997)10月21日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｂ２２Ｄ　11/06	３７０		Ｂ２２Ｄ　11/06	３７０Ｂ	
	３６０			３６０Ａ	

審査請求　未請求　請求項の数１　ＯＬ　（全４頁）

(21)出願番号　特願平8－83826

(22)出願日　平成８年(1996)４月５日

(71)出願人　000006655
新日本製鐵株式会社
東京都千代田区大手町２丁目６番３号

(72)発明者　山　田　利　男
川崎市中原区井田1618番地　新日本製鐵株式会社技術開発本部内

(72)発明者　坂　本　広　明
川崎市中原区井田1618番地　新日本製鐵株式会社技術開発本部内

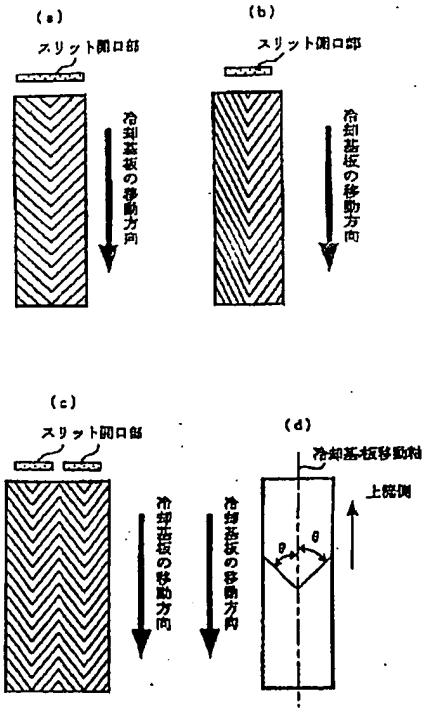
(74)代理人　弁理士　佐藤　一雄　（外２名）

(54)【発明の名称】　急冷金属薄帯製造用冷却基板

(57)【要約】

【課題】　パドルと溶湯との間にエアーが巻き込まれても、その排出が効率良く行われて容易に薄帯のエアーポケットを減少させ、冷却基板と溶湯との接触を効率よく維持し、特性が良好な薄帯が得られる、急冷金属薄帯製造用の冷却基板を提供すること。

【解決手段】　移動する冷却基板上に、スリット状の開口部を有する注湯ノズルを介して溶融金属を噴出させ、急冷凝固して急冷金属薄帯を製造する装置において、冷却基板の表面にＶ字状の溝を有し、かつ該Ｖ字状の溝の閉じた方向が冷却基板の移動方向に向いている冷却基板。



V字状の溝の配置が冷却基板の移動方向に対して開く様に配置された場合は、押し出されたエアーが薄帯幅方向の中央部に集合するため、エアーの排出が行われず従来同様エアーポケットは減少しない。生産性を上げる場合には、図1（c）に示す形態の冷却基板を用いればよい。

【0011】

【発明の実施の形態】本発明の急冷金属薄帯製造用の冷却基板について説明する。冷却基板の材質は、熱伝導率の大きいものが良い。例えば、Cu、Cu合金、Fe合金、あるいは、それらにCrメッキを施したものが適している。冷却基板としては、単ロール法、双ロール法等のロール方式が安定して薄帯を製造できるために適しているが、ベルト法でも本発明の効果は得られる。

【0012】冷却基板上のV字状の溝は、図1（a）、（b）および（c）に示すように冷却基板の移動方向に対して閉じるように配置される。溝の角度θは、図1（d）に示すように冷却基板の移動軸を基準とし、上流方向とのなす角が0°を超え90°未満である。エアーが効率良く排出され、より大きな効果を得るためには、その角度が20°～70°が望ましい。また溝は、V字状の閉じた部分を通る冷却基板の移動軸に対し、図1（b）のように左右異なった角度で配置されても良い。その場合、パドルを安定させるために、左右のθの差は±10°以内にすることが望ましい。V字状の溝の閉じた頂点部分は、薄帯幅の範囲内にあればよいが、薄帯幅方向の中央付近にある方がより好ましい。

【0013】溝の開口幅は、0．1～50μm程度が好ましい。0．1μm程度より小さくなるとエアーが効率良く溝の中を移動しなくなり、50μm程度より大きくなると溶湯も溝の中に入ってしまう確率が高くなり、エアーの移動を妨げてしまうからである。溝は、連続していることが好ましい。溝が連続していることによって、エアーが効率良く排出されるからである。溝の深さは10μm程度以上あれば良い。10μm程度より小さくなると、エアーが効率良く溝の中を移動しなくなるからである。

【0014】V字状の溝の閉じた頂点部分は、1mm程度以下の交差部があってもよい。交差部には下流側から移動してくるエアーが集まるが、V字状の溝とつながっているため、エアーが滞留する事はない。より大きな効果を得るには、交差部が完全に閉じていることが好ましい。溝と溝の間隔（ピッチ）は、200μm程度以下であれば良い。ピッチが200μm程度より大きくなると、巻き込んだエアーが効率良く排出されなくからである。冷却基板の溝は、機械研削、回転ブラシ、スタンプなどによって形成することができる。また、これらの方式は、オンラインでも行うことができる。

【0015】

らに説明する。

実施例1

本発明であるV字状の溝を有した冷却ロール（外径が580mmのCu製冷却ロール）を用いた単ロール法により薄帯を製造した。冷却ロールは、ロール表面を一旦鏡面状に研磨した後、機械研削でV字状の溝を形成させた。この溝は、V字状の閉じた部分を通る冷却ロールの移動軸を基準とし、上流方向とのなす角が左右とも45°の角度を持ち、溝の開口幅は30μm、溝の深さは16μm、溝のピッチは130μmであった。

【0016】比較例1

比較例1として、通常のエメリー紙による研磨を施した冷却ロール（外径が580mmのCu製冷却ロール）を用いた単ロール法により薄帯を製造した。この冷却ロールは600番のエメリー紙を用い、冷却ロールの移動方向に平行な研磨溝を有している。

【0017】比較例2

比較例2としては、本発明のV字状の溝の方向と逆である冷却基板の移動方向に開いたV字状の溝を配置した冷却ロール（外径が580mmのCu製冷却ロール）を用いた単ロール法により薄帯を製造した。この冷却ロールは、本発明の実施例1の冷却ロールと同様に、ロール表面を一旦鏡面状に研磨した後、機械研削でV字状の溝を形成させた。この溝は、V字状の閉じた部分を通る冷却ロールの移動軸を基準とし、上流方向とのなす角が左右とも120°の角度を持ち、溝の開口幅は30μm、溝の深さは16μm、溝のピッチは130μmであった。

【0018】本発明材および比較材1，2の薄膜の合金は、いずれも組成がFe80．5Si6．5B12Cl（原子%）である。この母合金750gを石英るつぼに装填し、高周波溶解した後、スリット状の開口部を持つノズルから周速24m／秒で高速回転する上記冷却ロール上に溶湯を噴出させ薄帯を得た。使用したノズルは単一スリットノズル（幅0．4mm、長さ25mm）である。得られた薄帯は、いずれも幅が25mm、板厚は27μmある。

【0019】薄帯の冷却ロール接触面（ロール面）を光顕写真に撮り、画像処理装置を用いてエアーポケットの面積率を調べた。また、この薄帯を360℃で1時間、窒素雰囲気中で磁場焼鈍し、SSTで磁気特性を測定した。その結果を、表1に示す。

【0020】

【表1】